

Timepiece with reversible watch case

The present invention relates to a timepiece with reversible watch case, and more particularly to a timepiece having a frame and a watch case reversibly mounted in the frame in order to be able to adopt a first position in which the dial of the watch case is visible and a second position or turned position in which the back cover or another dial of the watch case is visible.

Such timepieces have been described in the documents CH 181 003, CH 189 911 and FR 733 729. They all have the drawback of leaving a gap between the frame and the watch case when the latter is in either of the two positions mentioned above, which detracts from the aesthetic appearance of the timepiece.

The present invention aims at remedying this drawback, or at least at attenuating it, and provides to this end a timepiece, in particular a wristwatch, according to appended claim 1, particular embodiments being defined in the dependent claims.

Other features and advantages of the present invention will become apparent upon reading the following detailed description given with reference to the appended drawings in which:

- Figures 1 and 2 are profile views representing a watch according to a first embodiment of the invention, in an intermediate open position and in a closed position, respectively;
- Figures 3 and 4 are top and bottom views of the watch according to the first embodiment of the invention;
- Figure 5 is a partial profile view of the watch according to the first embodiment of the invention that shows particularly a setting crown and crown-protecting projections of this watch;
- Figure 6 is a cross-sectional view of the watch according to the first embodiment of the invention taken along the line VI—VI of Figure 3;
- Figure 7 is a partial cross-sectional view of the watch according to the first embodiment of the invention taken along the line VII, VIII of Figure 3, and representing particularly in an exploded position a tapped hole and a matching screw serving to assemble two parts of a frame of the watch; for reasons of clarity,

a bell and a mounting screw serving to assemble two parts of the watch case have not been represented in Figure 7;

- Figure 8 is a partial cross-sectional view of the watch according to the first embodiment of the invention taken along the line VII, VIII of Figure 3, and representing particularly the bell and the mounting screw mentioned earlier; for reasons of clarity, the tapped hole and matching screw illustrated in Figure 7 have not been represented in Figure 8;
- Figure 9 is a partial cross-sectional view of the watch according to the first embodiment of the invention taken along line IX of Figure 3;
- Figure 10 is a diagrammatic perspective view showing the watch according to the first embodiment of the invention in an open position;
- Figure 11 diagrammatically shows the watch case of a watch according to a second embodiment of the invention in perspective view (Figure 11a), in profile views (Figures 11b and 11d), and in top view (Figure 11c); and
- Figure 12 diagrammatically shows the watch case of a watch according to a third embodiment of the invention in perspective view (Figure 12a), in profile views (Figures 12b and 12d), and in top view (Figure 12c).

Referring to Figures 1 to 10, a timepiece of the wristwatch type according to a first embodiment of the invention comprises a support 1 of generally circular shape provided at two diametrically opposite ends with elements 2a, 2b for attachment to a bracelet (not shown). A frame 3 of annular shape without back cover and having an outer diameter larger than the diameter of support 1 is articulated at one of its ends with one end of support 1 via a hinge 4, and in its rest position is overlying support 1 concentrically to this support (Figure 2). This frame 3 consists of two pieces, a lower frame part 3a and an upper frame part 3b, assembled by means of screws 3c (Figure 7) regularly distributed within frame 3 and each screwed into a matching blind tapped hole 3d formed in frame 3. Screws 3c, of which just one can be seen in Figure 7, typically are four in number, but of course could be of a different number if so desired. The blind holes 3d open onto the lower face, designated 3e, of frame 3 so that the screws 3c will not be seen when the watch is on the wrist of the user and frame 3 is in its rest position.

It can be seen from Figures 1 to 4 that hinge 4 is comprised of a central part 4a, an outer part 4b that constitutes part of frame 3 and more particularly of the lower part 3a of this frame 3, and of screws 4c sitting inside of these central and outer parts 4a, 4b and defining the hinge's axis.

5 Two complementary hollows formed in parts 3a and 3b of frame 3 and located at a right angle to hinge 4 define a blind hole 3f (Figure 6) opening into the inside of frame 3 (Figure 6). This blind hole 3f receives a first end 5a of a pin 5. Two further complementary hollows formed in parts 3a and 3b, at the side diametrically opposite to blind hole 3f, define a through hole 3g allowing a crown's tube 6 to pass through the wall of frame 3. Pin 10 5 and the crown's tube 6 are secured to a watch case comprising a bezel or middle 7, a back cover 8, and a ring 9, and serve as a support for this watch case in frame 3. More particularly, a second end 5b of pin 5 is screwed and glued into ring 9, while a first end 6a of the crown's tube 6 is driven and glued into the same ring. The second end 6b of the crown's tube 6 is connected to a setting crown 10 outside frame 3. Ring 9 consists of a 15 single piece, and is housed in a seat formed partly in bezel 7 and partly in back cover 8, that is, a seat defined by two complementary hollows formed in the inner faces of bezel 7 and back cover 8, respectively. Ring 9 itself houses a clockwork movement 11 and a dial 12, the latter being topped by a glass 13 mounted in bezel 7. Pin 5 and the crown's tube 6 pass through diametrically opposite through holes 14, 15 each formed partly in bezel 7 and 20 partly in back cover 8 between the seat of ring 9 and the inner face of frame 3.

Advantageously, bezel 7 and back cover 8 are attached to each other by mounting bells 16, typically numbering four, that are regularly distributed along the periphery of the group of bezel 7 and back cover 8 (one of these bells 16 is represented in Figure 8). Each mounting bell 16 is generally cylindrically shaped and on one of its faces has a central 25 hollow 16a of truncated cone shape. Each mounting bell 16 is completely within a seat of matching shape provided partly in bezel 7 and partly in back cover 8, and is firmly held in this seat by a screw 17 extending in the plane of pin 5 and of the crown's tube 6 successively through a central through hole 18 formed in bell 16 and a through hole 19 formed partly in bezel 7 and partly in back cover 8, and up to the inside of a tapped blind 30 hole 20 formed in ring 9. Tapped blind hole 20 receives the threaded end of screw 17. The head of screw 17 is completely within the central through hole 18 of bell 16 and rests on a shoulder 21 defined by this hole 18. Each mounting bell 16 thus constitutes an element

anchored both in bezel 7 and back cover 8. In the use position of the watch, the mounting bells 16 face the inner face of frame 3, and hence are hidden by this frame, as represented in Figure 8.

Referring again to Figure 6, pin 5 consists of a cylindrical body 5c terminating at its end 5a in a hemispherical segment, and at its end 5b in a projection. The projection 5b and part of the cylindrical body 5c are housed in ring 9, while the hemispherical segment 5a and part of the cylindrical body 5c are freely housed in the blind hole 3f, that is, housed without being attached there. The bottom of blind hole 3f has a hemispherical shape corresponding to that of end 5a of pin 5. This hemispherical shape facilitates the realisation of blind hole 3f, in that each of the two half holes making up hole 3f can be milled with a spherical cutter set perpendicularly to the plane of the corresponding part 3a, 3b of frame 3. Pin 5 and the crown's tube 6 together define a geometric, diametric axis of rotation 22 of the watch case 7, 8, 9 relative to frame 3.

This way of mounting the watch case 7, 8, 9 into frame 3 makes the watch case 7, 8, 9 reversible. The watch case 7, 8, 9 can thus take up two rest positions or use positions parallel to frame 3. In the first position illustrated in Figure 6, dial 12 is visible but back cover 8 is hidden. In the second position (not represented), dial 12 faces the upper face of support 1, and hence is hidden, while the outer face of back cover 8 is visible. This outer face of back cover 8 may to this effect include decoration such as enamel transforming the watch into a piece of jewellery. In a variant, though, back cover 8 could be replaced by a second bezel holding a second dial and producing an aesthetic effect that differs from that of bezel 7 associated with dial 12.

For the watch case 7, 8, 9 to be turned over within frame 3, that is, to be changed from one rest position to the other, one first rotates the group consisting of frame 3 and watch case 7, 8, 9 relative to support 1 around the axis of rotation defined by hinge 4, as shown in Figure 1, until this group 3, 7, 8, 9 will form a sufficiently large angle with support 1. Then the watch case 7, 8, 9 is made to turn 180° around itself within frame 3, i.e. around the axis of rotation 22 that is fixed relative to frame 3, as shown in Figure 10, so that back cover 8 will take the place of bezel 7 and vice versa. One then folds the group consisting of frame 3 and watch case 7, 8, 9 back over the support 1. It will be noted that watch case 7, 8, 9 may be turned over while the watch remains at the user's wrist, since the

elements 2a, 2b for attachment to the bracelet are secured to support 1 and independent of frame 3.

Referring again to Figure 6, two metal rings 23a, 23b are housed in respective diametrically opposite hollows made in the flank or periphery 24 of the watch case 7, 8, 9, around pin 5 and the crown's tube 6, respectively, but project very slightly from this flank 24 to the outside of watch case 7, 8, 9. These rings 23a, 23b are in frictional contact with the flank or internal face, designated 25, of frame 3 and serve to suppress the play between the respective flanks 24, 25 of the watch case 7, 8, 9 and frame 3 in the direction of axis 22, and to prevent the flanks 24, 25 from touching each other. Annular friction joints 28a, 28b are surrounded and held compressed within flank 24 against respectively the periphery of pin 5 and the periphery of the crown's tube 6 by the rings 23a, 23b. It is the function of these joints 28a, 28b to produce friction with the inner flank of frame 3 during the rotation of watch case 7, 8, 9 in order to ensure that the watch case 7, 8, 9 will not turn inopportunely within frame 3, but only under the action of a torque imparted by the user. In an alternative embodiment of the invention, these rings 23a, 23b and these joints 28a, 28b could be housed within the inner flank 25 of frame 3, and produce friction with flank 24 of the watch case 7, 8, 9.

Preferably, locking means are further provided in order to hold frame 3 unlockably in its rest position relative to support 1 (Figures 2, 3). These locking means advantageously take the form of two ball thrusts 26a, 26b housed in two respective projections 1a, 1b of support 1 that are located on both sides of crown 10 and function as crown protectors, the balls 26c, 26d of these thrusts engaging as ratchets into matching hollows 27 formed in the outer flank of frame 3 (Figures 3, 5, 9). Other locking means (not represented) may equally well be provided to unlockably maintain the watch case 7, 8, 9 in one or the other of its rest positions relative to frame 3.

The watch according to the invention is made water-tight by annular gaskets 29a, 29b held in compression between bezel 7, respectively back cover 8, and the ring 9, as well as by an annular gasket 30 held in compression between bezel 7 and glass 13. On the other hand, sealing glue is used to glue the end 5b of pin 5 and the end 6a of the crown's tube 6 into ring 9.

According to the invention, the flank 24 of watch case 7, 8, 9 and the inner flank 25 of frame 3 substantially are parts of a same surface of revolution 31 around the axis of

rotation 22, in order to suppress or at least reduce the gap appearing between watch case 7, 8, 9 and frame 3. In this way, flank 24 of watch case 7, 8, 9 closely fits the inner flank 25 of frame 3 during rotary motions of watch case 7, 8, 9 around itself within frame 3.

In the example illustrated in Figures 1 to 10, the surface of revolution 31 is a sphere having its centre O located on axis 22, while flanks 24, 25 are parts of this sphere each limited by two parallel planes located on both sides of axis 22 and symmetric relative to this axis 22 (see Figure 6). Figures 11 and 12 illustrate two further embodiments in which the flank of the watch case and the inner flank of the frame each have shape discontinuities. For the sake of clarity, only the watch case has been represented in Figures 11 and 12, but it will be understood that the inner flank of the frame has the same shape as the flank of the watch case. It is apparent in these Figures 11 and 12 that the flank of the watch case consists of two first opposite parts located on either side of the axis of rotation 22, and of two second opposite parts that intersect the axis of rotation 22 and interconnect the first parts. In the embodiment shown in Figure 11, the first parts here designated 32a and 32b have, in a plane perpendicular to the axis of rotation 22, a first radius of curvature R1 and a centre of curvature C1 located on axis 22 (see Figure 11b) and, in a plane containing axis 22 and running perpendicularly to the aforesaid plane, a second radius of curvature R2 larger than R1 (see Figure 11c); the second parts, designated 33a and 33b, are spherical with a radius of curvature R3 (see Figures 11c and 11d), and their respective centres of curvatures are located on axis 22. In the embodiment illustrated in Figure 12, the first parts designated 34a and 34b have, in a plane perpendicular to the axis of rotation 22, a radius of curvature R4 and a centre of curvature C4 located on axis 22 (see Figure 12b), and are straight within a plane containing the axis 22 and running perpendicularly to the aforesaid plane (see Figure 12c); the second parts, designated 35a and 35b, are flat and perpendicular to axis 22. The flank 34a, 35a, 34b, 35b thus consists of a cylindrical part bounded by two mutually parallel planes located on either side of axis 22 and running parallel to this axis.

In each of the embodiments illustrated in Figures 1 to 10, 11 and 12 the axis of rotation 22 is an axis of symmetry for the flank of the watch case and the inner flank of the frame, and these flanks have a same constant height H (see Figure 6). In a variant, though, the axis of rotation 22 while still being located within a plane of symmetry of the flank of the watch case that is perpendicular to the plane of the watch case, could be eccentric with

respect to this flank, that is, the flank of the watch case could be higher on one side of axis 22 than on the other, for instance in order to impart a particular aesthetic appearance to the watch in one of the two rest positions of the watch case within the frame. In a variant, also, the flank of the watch case and the inner flank of the frame could have different heights, for instance the flank of the watch case could be higher than the inner flank of the frame, in order to confer a particular aesthetic effect.

Furthermore, although the frame as represented in Figures 1 to 10 is closed, that is, surrounds the watch case along its entire periphery, the frame of the watch according to the invention could in a variant be open. In the examples illustrated in Figures 11 and 12, the frame could more particularly have the shape of a U.

Referring again to Figures 1 to 10, the watch according to the invention is assembled as follows.

1. The crown's tube 6 is driven and tightly glued into ring 9, and pin 5 is screwed and tightly glued into the same ring 9.
2. The clockwork movement 11 and the dial 12 with the corresponding hands are mounted into ring 9.
3. Glass 13 and its sleeve (annular gasket 30) are driven into bezel 7.
4. Gasket 29a is mounted into bezel 7. The group consisting of ring 9, movement 11 and dial 12 is placed into bezel 7. The gasket 29b is placed against ring 9, and back cover 8 is positioned. While holding this group 7 – 9, 11, 12 between two fingers, the mounting bells 16 are put into their respective seats and then screwed into ring 9.
5. The group 7 – 9, 11, 12 is placed into the lower frame part 3a and upper frame part 3b forming the frame 3, then frame parts 3a, 3b are fastened to each other with screws 3c. One will note in this respect that one function of the two frame parts 3a, 3b consists of enabling the group 7 – 9, 11, 12 to be mounted into the frame 3, despite the play between the watch case 7 – 9 and the frame 3 being almost absent and flank 24 of watch case 7 – 9 as well as the inner flank 25 of the frame 3 having the shape of parts of a surface of revolution.
6. The ball thrusts 26a, 26b are driven into the projections 1a, 1b of support 1, and screws 4c are placed into hinge parts 4a, 4b in order to articulate group 3, 7 – 9, 11, 12 with support 1.